

LATE MIOCENE MARINE BIRDS FROM ORANGE COUNTY, CALIFORNIA¹

By HILDEGARDE HOWARD²

ABSTRACT: Bone fragments from five sites in the Late Miocene Monterey Formation at Laguna Niguel, Orange County, California, represent at least 14 species of marine birds, *Gavia brodkorbi* n. sp., *Diomedea* ?*californica*, *Diomedea* sp., *Puffinus barnesi* n. sp., *Oceanodroma* sp., *Osteodontornis orri* Howard, *Morus lomipocanus* (Miller), *Morus magnus* n. sp., ?*Miosula media* Miller, ?*Uria* sp., ?*Cephus* sp., ?*Aethia* sp., *Fraterculini* gen. and sp. indet., and *Praemancalla wetmorei* Howard. The avifauna suggests a slightly younger phase of the Late Miocene than another avifauna previously reported from the Monterey Formation in Laguna Hills, three miles northward.

INTRODUCTION

In 1969, during the excavation for the North American Rockwell Building (now United States General Services Administration Building) on El Lazo Road in Laguna Niguel, Orange County, California, fossiliferous sands and siltstones of the Late Miocene Monterey Formation (Clarendonian correlative) were exposed. Marine mammals and birds were collected in the actual building excavation and, from 1969 to 1976, in adjacent hillsides within a half-mile radius of the El Lazo site.

The localities, all of which bear Natural History Museum of Los Angeles County (LACM) locality numbers, are listed below (numbers in parentheses indicate the number of avian bones found). Detailed locality descriptions with reference to the San Juan Capistrano Quadrangle, U.S.G.S. 7.5 minute, 1948 edition, are on file in the Section of Vertebrate Paleontology, LACM.

LACM Loc. 3185 — Aliso Creek. From coarse yellow sand. (3)

LACM Loc. 6901 — El Lazo Road. In laminated gray to white siltstone. (1)

LACM Loc. 6902 — El Lazo Road. From coarse yellow sands overlying siltstones described in LACM 6901. (21)

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- LACM Loc. 6906 — Site of excavation for North American Rockwell Building on El Lazo Road. In yellow sands and laminated gray siltstone. (21)
- LACM Loc. 7136 — Moulton Parkway. In phosphatic pebble bed, in a gray siltstone. (5)

MATERIAL

Fifty-one avian bone fragments were recovered from the Laguna Niguel localities. These are in the collections of the Natural History Museum of Los Angeles County (LACM). Thirty-nine are identified and assigned to seven families.

Comparative fossil material used in connection with this study is largely in the LACM collections and includes, in addition to LACM types and referred specimens, casts of types of *Gavia concinna* Wetmore 1940; *Diomedea californica* Miller 1962; *Puffinus conradi* Marsh 1870; *P. diatomicus* Miller 1925; *P. inceptor* Wetmore 1930; *P. mitchelli* Miller 1961; *P. priscus* Miller 1961; *Osteodontornis orri* Howard 1957; *Sula willetti* Miller 1925; *Morus lompopanus* (Miller 1925); *Miosula media* Miller 1925; *Palaeosula stocktoni* (Miller 1935); and *Uria antiqua* (Marsh 1870).

In addition, the following material was made available on loan: from the Museum of Comparative Zoology, Harvard University (MCZ), referred tibiotarsus (Wetmore 1943) of *Diomedea anglica* Lydekker 1891; from the Museum of Paleontology, University of California, Berkeley (UCMP), type and reverse of type of *Miosula media* Miller 1925, and figured specimens of *Morus lompopanus* (Miller 1925:pls. 7 and 9); from the United States National Museum of Natural History (USNM), previously unreported referred humerus and ulna of *Miocepphus mcclungi* Wetmore 1940, identified by Storrs Olson.

Recent skeletal material used for comparison is largely from the LACM collections, but also includes skeletons of Alcidae obtained on loan from the Museum of Vertebrate Zoology, University of California, Berkeley (MVZ) and California State University, Long Beach (CSLB), and a skull of *Morus bassanus* lent by Pierce Brodkorb, University of Florida, Gainesville (PB).

HISTORICAL REVIEW

Miller (1925) was the first to document Miocene birds from marine deposits in California, naming three species of sulids, a shearwater, a godwit and an auklet from the Late Miocene diatomaceous shales of the Sisquoc Formation near Lompoc, Santa Barbara County. Within the next ten years three sites in Los Angeles County yielded Late Miocene avian fossils: the Modelo Formation at Calabasas (Miller 1929), and the Monterey Formation at Lomita and San Pedro (Miller 1935). Also, in the same decade (1925-1935), the first avian bones from the Middle Miocene (Round Mountain Silt) Sharktooth Hill

Bonebed were recorded (Wetmore 1930). By the end of 1935, 11 species had been described.

No further marine birds from the California Miocene were added until the 1950's when a flagstone quarry in the Monterey Formation in Tepusquet Canyon, Santa Barbara County, yielded two avian skeletons. Both were described under extinct families (Howard 1957a and 1957b). Later excavations in the San Fernando Valley and at El Sereno, Los Angeles County, yielded additional records of some of the previously described species and added a new sulid (Howard 1958, and Howard and White 1962). Miller (1951) described a storm petrel during this decade, from the Capistrano Formation near San Juan Capistrano, Orange County. The age of the deposit was given as Middle Miocene, but is now considered to be either Late Miocene or Early Pliocene (Fife 1974:19).

The 1960's added two Miocene bird localities in California: the Jewett Sand at Pyramid Hill, Kern County (Early Miocene) yielded a single bone described in a new family related to the cormorants (Howard 1969), and a large collection from the Monterey Formation at Leisure World, Laguna Hills, Orange County added five new species (Howard 1966a and 1968). Also, within the last 16 years, five additional species have been described from the Sharktooth Hill Bonebed (Miller 1961 and 1962; Howard 1966b; Warter 1976).

In seven of the 11 areas in California from which Miocene marine birds have been previously obtained, the specimens occur as partial skeletons or skeletal impressions on slabs of shale. Such specimens include the types of 12 of the 26 recorded species. While these specimens provide information on the proportions of the birds involved, the finer details of structure are usually not clearly preserved. Consequently it becomes difficult to compare these specimens with the isolated, mineralized bone fragments obtained from localities such as Sharktooth Hill, Pyramid Hill, Laguna Hills Leisure World, or the area discussed herein.

In the following list of species from previously recorded marine Miocene sites in California, those based on partial skeletons in shale slabs are marked with an asterisk.

Procellariiformes

Diomedidae: *Diomedea californica* Miller 1962; *D. milleri* Howard 1966.

Procellariidae: **Puffinus diatomicus* Miller 1925; *P. inceptor* Wetmore 1930; *P. mitchelli* Miller 1961; *P. priscus* Miller 1961; *P. calhouni* Howard 1968; *Fulmarus hammeri* Howard 1968.

Hydrobatidae: **Oceanodroma hubbsi* Miller 1951.

Pelecaniformes

Pseudodontornithidae: **Osteodontornis orri* Howard 1957.

Sulidae: **Sula willetti* Miller 1925; **Sula pohli* Howard 1958; **Morus lompocanus* (Miller 1925); *M. vagabundus* Wetmore 1930; **Palaeosula stocktoni* (Miller 1935); **Miosula media* Miller 1925.

Phalacrocoracidae: **Phalacrocorax femoralis* Miller 1929.

Plotopteridae: *Plotopterum joaquinensis* Howard 1969.

Anseriformes

Anatidae: *Presbychen abavus* Wetmore 1930.

Falconiformes

Pandionidae: *Pandion homalopteron* Warter 1976.

Charadriiformes

Scolopacidae: **Limosa vanrossemi* Miller 1925.

Alcidae: *Aethia rossmoori* Howard 1968; **Cerorhinca dubia* Miller 1925;

Alcodes ulnulus Howard 1968; *Praemancalla lagunensis* Howard 1966.

Passeriformes

Palaeoscinidae: **Palaeoscinis turdirostris* Howard 1957.

The species represented at Laguna Niguel bring the total for the Alcidae to five identified species, and the totals for the Procellariidae and the Sulidae to seven species each. The Order Gaviiformes (Gaviidae, 1 species) is added to the California Miocene list.

SYSTEMATICS
ORDER GAVIIFORMES

FAMILY GAVIIDAE — LOONS
GENUS *Gavia* FORSTER 1788
Gavia brodkorbi NEW SPECIES

FIGURE 1 A, B

Holotype. — Complete left ulna, LACM 31173, collected by Marion J. Bohrer, 1969, from locality LACM 6906.

Diagnosis. — Ulna relatively short and stout; proximally, attachment for anterior articular ligament short and broad (roughly triangular), and prominently set off from shaft, with brachial impression deeply rimming its palmar edge; distal tip of external cotyla bent toward shaft, with short scar running mediad directly beneath, confining small radial impression; distally, large carpal tuberosity jutting abruptly from shaft.

Measurements. — Greatest length 81.0 mm, breadth across proximal cotylae 9.4 mm, breadth of shaft at middle 4.9 mm, greatest breadth of distal and (through carpal tuberosity) 11.3 mm, depth of distal end through external crest of trochlea 7.5 mm, length of attachment for anterior articular ligament 4.4 mm, breadth of same 4.0 mm.

Etymology. — The species is named in honor of Pierce Brodkorb in recognition of his many contributions to Paleornithology, including a review of fossil loons.

Discussion. — The fossil ulna is 25 mm (23.6%) shorter than the minimum for this element in four LACM specimens of the Red-throated Loon, *Gavia stellata* (Pontoppidan 1763), but is relatively stouter. The proximal radial impression is more confined than in *G. stellata*, *G. pacifica* (Lawrence 1848), or *G. immer* (Brunnich 1764). Distally, the carpal tuberosity is more square in outline than in these Recent loons. The short, broad attachment of the anterior articular ligament, also, is distinct (the attachment is longer and more oval in the Recent species).

A photograph of an ulna of *Colymboides minutus* Milne-Edwards 1867 from the Early Miocene of France, illustrated by Storer (1956, Fig. 1, g) shows the attachment of the anterior articular ligament to be broad and short. Storer, however, notes that, unlike the ulna of all Recent loons, this element of *Colymboides* lacks the groove bordering the attachment posteriorly. This groove is present in *G. brodkorbi*. Furthermore, the carpal tuberosity in *Colymboides* is less abruptly projected than in *G. brodkorbi* or in any of the Recent loons.

The only previous Miocene record of the genus *Gavia* was based on a poorly preserved tibiotarsus from the Calvert Formation, Maryland, cited by Wetmore (1941) as *Gavia* sp. Four species have been described from the Pliocene: *Gavia portisi* (Regalia 1902), Middle Pliocene of Italy; *Gavia concinna* Wetmore 1940, Early Pliocene of Florida and Middle and Later Pliocene of California; *Gavia palaeodytes* Wetmore 1943, Early Pliocene of Florida; *Gavia howardae* Brodkorb 1953, Late Pliocene of California.

According to Brodkorb (1953), who reviewed these species, *Gavia portisi* is known only from a cervical vertebra that is nearly as large as that of *G. immer*. The type of *G. concinna* is an ulna much larger than that of *G. brodkorbi* (breadth across proximal cotylae 11.6 mm), and is further distinguished by a longer attachment for the anterior articular ligament. *G. palaeodytes* is known from coracoid, humerus and femur, all equal to, or slightly larger than comparable specimens of *G. stellata*, hence larger than would be expected for *G. brodkorbi*.

Gavia howardae was described from an incomplete humerus with two additional humeral specimens referred (all LACM). The smallest referred humerus provides a measurement of length (from distal end to distal tip of deltoid crest) of 91.5 mm, which is 14% less than the minimum for this same measurement in *G. stellata* (106.5 mm). The type of *G. howardae* is incomplete, but appears to have been longer than the referred specimen (possibly within 7 mm of the minimum for *G. stellata*). Relative breadth is difficult to determine in these incomplete specimens. They appear, however, to be of less stocky proportions than the ulna of *G. brodkorbi*. Qualitatively there is little on which to base comparison of the humerus of *G. howardae* with the ulna of *G. brodkorbi*. However, the long, narrow attachment for the anterior articular

ligament on the humerus of *G. howardae* closely resembles the condition found in *G. stellata* and is unlikely to correspond with the unusually short, broad attachment for this ligament on the ulna of *G. brodkorbi*.

ORDER PROCELLARIIFORMES
FAMILY DIOMEDEIDAE — ALBATROSSES
GENUS *Diomedea* LINNAEUS 1758
Diomedea ?*californica* MILLER 1962

FIGURE 2 C

Referred material. — Distal end of tibiotarsus, LACM 37629, from locality LACM 6906.

Discussion. — Four species of fossil albatrosses have been previously named: *D. californica* Miller 1962 and *D. milleri* Howard 1966b, from the Middle Miocene of Sharktooth Hill, California; *D. thyridata* Wilkinson 1969, from the Late Miocene of Australia; and *D. anglica* Lydekker 1891, from the Pliocene of England (type) and Florida (specimen referred by Wetmore 1943).

D. milleri was described from an ulna with referred tarsometatarsus, both of which are smaller than comparable elements of *D. nigripes* Audubon 1839. *D. thyridata*, described from a rostrum, is likened in characters and size (Wilkinson 1969) to *D. melanophris* Temminck 1828. It would appear, therefore, that both *D. milleri* and *D. thyridata* were species whose size range was below that possible for the species represented by the tibiotarsus in the present collection.

D. californica and *D. anglica*, both described from the tarsometatarsus, were larger species than either *D. milleri* or *D. thyridata*. The referred specimen of *D. anglica* is a distal end of tibiotarsus. This specimen (MCZ 2328) was made available for the present study (Fig. 2, B). In distal breadth LACM 37629 from Laguna Niguel is only slightly larger than MCZ 2328. It differs from the latter, however, in less depression of the supratendinal bridge, and in having a well-developed, papilla-like internal ligamental attachment. In both of these characters LACM 37629 resembles *D. exulans* Linnaeus 1758, whereas MCZ 2328 more closely resembles *D. albatrus* Pallas 1769, in which the bridge is more depressed and the ligamental attachment is only a scar. Both fossil specimens differ from *D. exulans* in more horizontal position of the lower opening of the tendinal canal, but in MCZ 2328 the opening is more restricted in lateral extent than in LACM 37629.

Comparison of the Laguna Niguel specimen with *D. californica* rests entirely on size, as no tibiotarsus assignable to this species has yet been forthcoming from the Sharktooth Hill Bonebed. A second tarsometatarsus (LACM 18203) from that locality is, however, now at hand. This is slightly larger, but otherwise similar to the holotype. The distal breadths in the two tarsometatarsi of *D. californica* are 92.3% (holotype) and 96.4% (LACM 18203, referred) of

this dimension in a tarsometatarsus (LACM Bi230) of *D. exulans*. Compared with the tibiotarsus of the same specimen of *D. exulans*, the distal breadth of tibiotarsus LACM 37629 from Laguna Niguel is 96.7% (Table I). It appears reasonable, therefore, to assign this specimen to *D. californica*. However, being unable to compare it with a tibiotarsus from the type locality of *D. californica*, the assignment is tentative.

Diomedea SP. INDETERMINATE

FIGURE 2 A, D

Referred material. — Proximal section of humerus, LACM 58544, from locality LACM 6902, and distal end of radius, LACM 31172, from locality LACM 6906.

Discussion. — These poorly preserved wing bones are notably smaller relative to those of *D. exulans* than is the case with the tarsometatarsi of *D. californica* or tibiotarsus LACM 37629. They are somewhat smaller, also, than a distal end of humerus from the Sharktooth Hill Bonebed previously referred to *D. californica* (Howard 1966b) (see Table I).

The incomplete humerus lacks the tip of the internal tuberosity, the bicipital crest and a large portion of the deltoid crest. It resembles the humerus of *D. exulans* in the broad curvature of the anconal face of the shaft, but the area immediately below the head is less depressed. On the palmar surface, the enlarged distal tip of the deltoid crest resembles the condition in *D. exulans*, but the crest is much shorter in the fossil. The radius is too poorly preserved for analysis, but provides a measurement of distal breadth (Table I).

FAMILY PROCELLARIIDAE — SHEARWATERS

GENUS *Puffinus* BRISSON 1790

Four wing bones are referable to the genus *Puffinus*. Thirteen species of middle to late Tertiary shearwaters of this genus have been described from Europe and North America, eight of which are from the west coast (see Brodkorb 1963b, and Howard 1968 and 1971).

After consideration of these species, and careful comparison with specimens of all those from California, I find it necessary to add still another species, which I refer to the subgenus *Puffinus*.

Puffinus barnesi NEW SPECIES

FIGURE 1 E, F

Holotype. — Left humerus lacking proximal end, LACM 42652, collected by W. Earl Calhoun, July 1969, from locality LACM 6906.

Diagnosis. — Humerus with shaft laterally compressed above distal end,

TABLE 1

Comparison of Fossil and Recent Specimens of *Diomedea*

	Measurements in Millimeters				Ratio Fossils to Recent (In Per Cent)		
	<i>D. calif- ornica</i> *	<i>D. sp.**</i>	<i>D. ang- lica</i> ***	<i>D. exu- lans</i> ****	<i>D. calif- ornica</i> *	<i>D. sp.**</i>	<i>D. ang- lica</i> ***
Tarsometatarsus							
Distal breadth	20.6-21.5	....	19.3	22.3	92.4- 96.4	....	86.5
Breadth shaft	9.0-10.0	....	....	9.1	96.8-109.0	....	....
Proximal breadth	....	....	20.7	23.2	....	....	89.1
Tibiotarsus							
Distal breadth	....	20.6	20.2	21.3	....	96.7	94.8
Breadth shaft	....	10.0	9.5	10.0	....	100.0	95.0
Humerus							
Proximal breadth	....	39.2	....	48.5	....	80.8	....
Distance head to end deltoid crest	....	64.5	....	83.7	....	77.0	....
Distal breadth	27.5	....	....	31.6	87.0	....	....
Radius							
Distal breadth	....	11.7	....	14.6	....	80.0	....

*Type and referred specimens from Sharktooth Hill

**Specimens from Laguna Niguel (tibiotarsus referred *D. ?californica*)

***Type tarsometatarsus, referred tibiotarsus

****LACM no. Bi230

but slightly rounded in contour; internal side of distal end relatively short in anconopalmar dimension, and anconal tip swollen laterally; impression of brachialis anticus small, and short in proximo-distal dimension; ectepicondylar process situated relatively near to distal end; attachment of anterior articular ligament turned slightly laterally rather than facing directly palmad.

Measurements. — Length from distal end to distal tip of deltoid crest 67.0 mm (estimated total length 80 mm), breadth of distal condyles 7.7 mm, depth of internal side of distal end 8.4 mm, distance from distal surface of condyle to proximal edge of ectepicondylar process 9.5 mm, shaft dimensions near distal end 3.5 mm in breadth, 5.7 mm in depth, shaft dimensions (middle) 3.9 mm in breadth, 5.9 mm in depth.

Etymology. — The species is named for Lawrence G. Barnes in recognition of his paleontological studies of the marine vertebrates of the west coast.

Discussion. — The holotype of *P. barnesi* is comparable in general size to the humerus of *Puffinus opisthomelas* Coues 1864. Although the shaft is compressed laterally as in that Recent species, it is slightly more rounded and less bladelike in the fossil.

With the exception of *Puffinus tedfordi* Howard 1971, from the Almejas

Formation of Cedros Island, Baja California, Mexico, and *P. arvernensis* Milne-Edwards 1871, from the Early Miocene of France, all previously described Tertiary representatives of this genus are known from the humerus. Shufeldt (1896) referred a humerus to *P. arvernensis*, but according to Storrs Olson (personal communication), who has examined the specimen, it comes from a Pleistocene locality and should be assigned to the Recent species *Puffinus puffinus* (Brunnich 1764). The holotypes of both *P. tedfordi* and *P. arvernensis* are tarsometatarsi. In both species, this element suggests a stouter bird than is represented by the wing of *P. barnesi*.

Judging from the descriptions given by Milne-Edwards (1874), the type humeri of his species *Puffinus aquitanicus* and *P. antiquus*, from the Middle Miocene of France, both exceed *P. barnesi* in size. Also, as indicated by a cast of the type of *P. conradi* Marsh 1870 (LACM C688), that species was markedly larger than *P. barnesi*. At the opposite extreme, Brodkorb's (1963a:161) measurements of the type humerus of his species *P. micraulax*, from the Hawthorne Formation, Early Miocene of Florida, show that species to be notably smaller than *P. barnesi*.

Original material or casts of all the California species of Tertiary *Puffinus* have been examined, including topotypical specimens of humeri referable to *P. mitchelli* Miller 1961 (LACM 17500) and *P. priscus* Miller 1961 (LACM 17502 and LACM 18140) recovered since the last report on the avifauna of the Middle Miocene of Sharktooth Hill (Howard 1966b).

Of the California species, the humeri of *P. felthami* Howard 1949 (Middle Pliocene of Orange County) and *P. mitchelli* are larger than *P. barnesi*. *P. inceptor* Wetmore 1930 (Middle Miocene, Sharktooth Hill) agrees in some dimensions, but the marked medial thrust of the internal condyle and the greater anconopalmar dimension of the internal side of the distal end are distinctive characters of *P. inceptor*. Also, the brachial impression in that species is more distally developed. In *P. calhouni* Howard 1968 (Late Miocene, Orange County) and *P. priscus* the shaft is more compressed and blade-like than in *P. barnesi*. The ratio of breadth to depth of shaft near the distal end in *P. barnesi* is 61%, in *P. calhouni* 50%, and in *P. priscus* 48-53%.

An excellent relief cast (LACM C692) from the holotype skeletal impression of *P. diatomicus* Miller 1925 (Late Miocene, Lompoc) clearly reveals characters of the palmar aspect of the distal end of the humerus. The impression of the brachialis anticus is more distally extended than in *P. barnesi* and the ectepicondylar process is placed higher above the distal end (11.6 mm from distal surface of condyle to proximal tip of process).

Most closely approaching *P. barnesi* in general size are the paratype and referred humeri of *P. kanakoffi* Howard 1949 (LACM specimens), from the San Diego Formation. This Pliocene species is distinguished, however, by a longer brachial impression, less rounded shaft (though less compressed than in *P. priscus*), less inflated anconal tip of the internal condyle, and more palmar-facing attachment for the anterior articular ligament.

Referred material. — A left ulna, lacking the olecranon (LACM 42654)

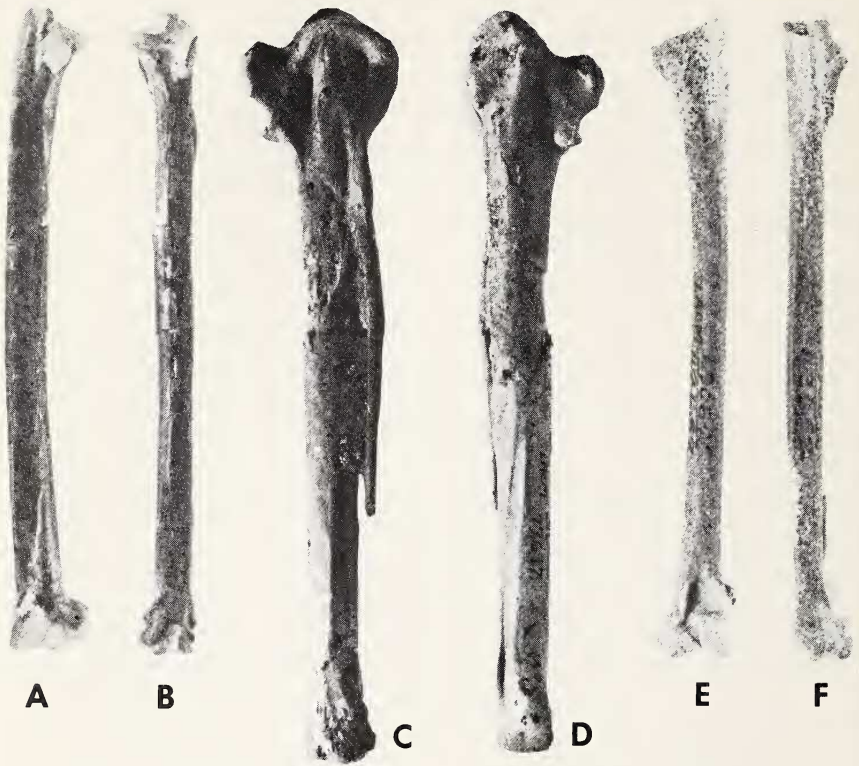


FIGURE 1. A, B, *Gavia brodkorbi* n. sp. holotype ulna, LACM 31173, internal and palmar views. C, D, *Morus lompocanus* Miller referred carpometacarpus, LACM 77697, internal and external views. E, F, *Puffinus barnesi* n. sp. holotype humerus, LACM 42652, palmar and internal views. X 1

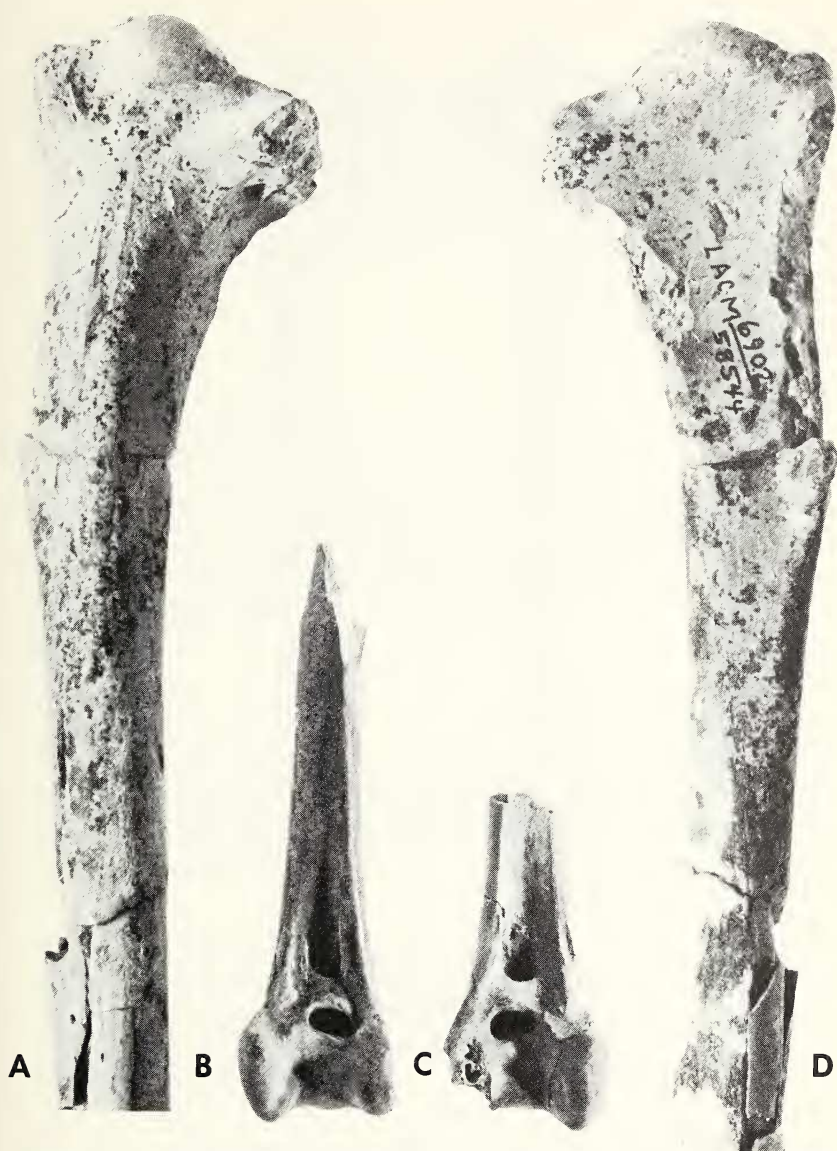


FIGURE 2. A and D, *Diomedea* sp. indet., proximal portion of humerus, LACM 58544, anconal and palmar views. B, *Diomedea anglica* Lydekker, referred distal end of tibiotarsus from Pierce, Florida, MCZ 2328, anterior view. C, *Diomedea* ?*californica* Miller, referred distal end of tibiotarsus, LACM 37629, anterior view. X 1



FIGURE 3. A and D, *Osteodontornis orri* Howard, referred proximal half of left carpometaarpus, LACM 53906, posterior and internal views. B, C, *Morus magnus* n. sp. holotype carpometaarpus, LACM 37632, internal and external views. X 1

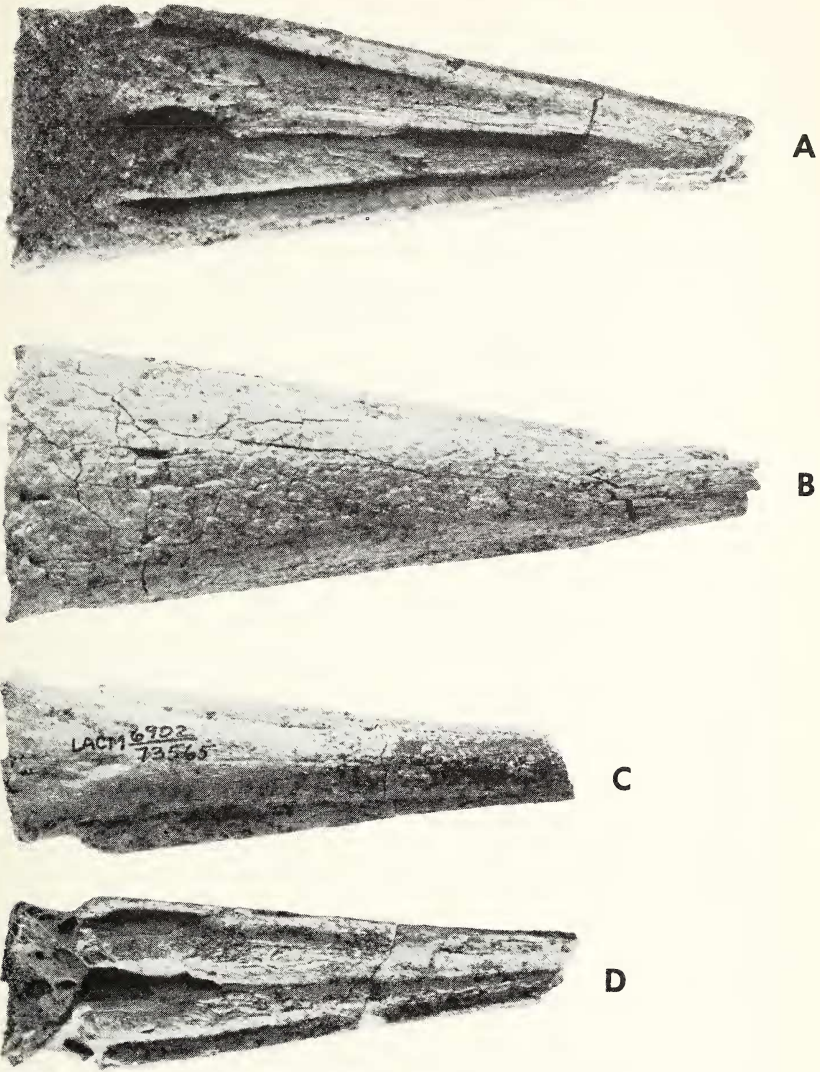


FIGURE 4. A, B, *Morus magnus* n. sp., referred rostrum, LACM 77696, ventral and dorsal views. C, D, *Sulidae* sp. indet., rostrum, LACM 73565, dorsal and ventral views. X 1

from the type locality, LACM 6906. Although smaller than would be expected for the wing of the same individual as the holotype, this specimen (like the humerus) falls within the size range of *P. opisthomelas* (ulnar length, 68.3-76.3 mm), though near the minimum; the holotype humerus is near the maximum size of *P. opisthomelas*. The few characters discernible in the poorly preserved ulna are: carpal process as in *P. opisthomelas*, shorter than in a topotype ulna of *P. kanakoffi* (LACM 2821, previously unreported), and more abruptly projected; external cotyla not prominently projected palmar; ridge present from external cotyla to shaft; attachment for anterior articular ligament seemingly more protruding than in *P. opisthomelas*; but the area is broken.

Measurements of ulna: length to intercotylar ridge 70.8 mm, breadth of proximal end 6.5 mm, greatest breadth of distal end 6.4 mm, depth through external crest of trochlea 5.3 mm, shaft dimensions (middle) 3.5 mm × 5.3 mm.

Another poorly preserved fragment of a distal end of an ulna (LACM 52748) from locality LACM 7136, has a distal breadth of approximately 6.3 mm. A wing phalanx (digit 2, phalanx 1), LACM 53925 from locality LACM 3185, measures 20.4 mm in length, which is within the size range of this element of *P. opisthomelas*. These two specimens are tentatively assigned to *P. barnesi*.

FAMILY HYDROBATIDAE — STORM PETRELS

GENUS *Oceanodroma* REINCHENBACH 1852

Oceanodroma SP. INDETERMINATE

Referred material. — A single incomplete right tarsometatarsus, LACM 42659, from locality LACM 6902, represents this family and genus.

Discussion. — The specimen resembles this element in *O. melania* (Bonaparte 1854), but is slightly longer. The length from distal end to proximal tip of hypotarsus is 31.5 mm. The distal end appears to be narrower than in *O. melania*, but the preservation is such that accurate measurement is impossible.

The only previously recorded Tertiary storm petrel is *O. hubbsi* Miller 1951, from the Capistrano Formation (Late Miocene-Early Pliocene), Orange County, a few miles south of the Laguna Niguel localities. The tarsometatarsus is represented in the type, partial skeleton, of this species preserved in shale. Miller (1951) gives the length of this element as 22.4 mm, markedly less than even the incomplete measurement possible on the specimen now at hand.

ORDER PELECANIFORMES

FAMILY PSEUDODONTORNITHIDAE — BONY-TOOTHED BIRDS

GENUS *Osteodontornis* HOWARD 1957

Osteodontornis orri HOWARD 1957

FIGURE 3 A, D

Referred material. — Lower jaw fragment, LACM 22444, and carpometacarpus, LACM 53906, with portion of proximal end and shaft, both

from locality LACM 6902; portion of lower jaw, LACM 42656, with a single "tooth," from locality LACM 7136.

Discussion. — The jaw fragments resemble previously recorded specimens of *Osteodontornis* (Howard 1957a, and Howard and White 1962), although they seem somewhat smaller than the type of *O. orri*.

The fragment of carpometacarpus, however, conforms in size to the left carpometacarpus on the type skeleton, a cast of which is at hand. In fact, the specimen from locality 6902 fits exactly into the impression of the left carpometacarpus on type Slab No. 1 (LACM C703, Block No. 1), in which the large pisiform process has left a deep depression. The present specimen not only clarifies that this depression, was, indeed, made by the pisiform process, but also reveals other characters only suggested in the type, namely, the length of the process of metacarpal 1 and the great compression of metacarpal 3 (M3) to metacarpal 2 (M2). The very thin M3 is pressed against M2 even distal to the proximal metacarpal symphysis, and the symphysis itself extends almost to the level of the distal tip of the process of M1.

Metacarpal 1 is broken in both the type and LACM 53906, but the area of its attachment to the element as a whole is indicated in the type and clarified in the broken edges of the process on the carpometacarpus from Laguna Niguel. The length of M1 measured on LACM 53906, is 62.2 mm, approximately one-fourth the total length of the carpometacarpus as seen in the type (252 mm). Enough of the proximal end of LACM 53906 is preserved to obtain an approximate breadth of the proximal trochlea (15.2 mm). The antero-posterior dimension of the trochlea cannot be measured, but it is obvious that the posterior portion is short in distal extent. Shaft breadths of M2 and M3 are 11.0 mm and 4.0 mm respectively. The depth through the compressed M2 and M3 is 16.4 mm. The incomplete specimen measures 126.4 mm from trochlea to broken end of M2.

Except for a prominent pneumatic foramen above the pisiform process, which occurs in most sulids, there is nothing about this highly compressed carpometacarpus to relate it to the Pelecaniformes. I have previously contended (Howard 1957a) that the bony-toothed birds represent a distinct order, Odontoptorigiformes.

FAMILY SULIDAE — BOOBIES AND GANNETS

The family Sulidae is the best represented family in the Laguna Niguel collection and the one which has presented the greatest difficulty in identification. Fifteen middle and late Tertiary sulids have been previously described from North America and Europe (see Brodkorb 1963b:257-261), eight of which are from California (six Miocene, two Pliocene). Five of the species are based on partial skeletons in shale slabs, the others on individual bones involving four different incomplete skeletal elements. A complete review of the known fossils of this family is greatly to be desired. This is a task that some energetic young paleontologist may profitably undertake.

Sixteen bones in the present collection are assignable to at least three species. In spite of the difficulty experienced in correlating the previously described species, I feel justified in describing one new species and in assigning several specimens to one previously described.

GENUS *Morus* VIELLOT 1816
Morus lompocanus (Miller 1925)

FIGURE 1 C, D

Referred material. — Carpometacarpus, LACM 37634; distal end of ulna, LACM 37636; and distal end of femur, LACM 37633; all from locality LACM 6902; carpometacarpus, LACM 77697, from locality 6901; proximal end of tarsometatarsus, LACM 32428 from locality LACM 6906; proximal end of tarsometatarsus, LACM 42657, from locality LACM 7136; distal end of tibiotarsus, LACM 52217, from locality LACM 3185.

Discussion. — *Morus lompocanus* was described (Miller 1925) from the impression of a partial skeleton in a slab of diatomaceous shale from Lompoc, California. Although the holotype (UCMP 26544) was the only specimen described in the text, two other partial skeletons from the same site were so named and illustrated (op. cit.: pl. 7B and pl. 9). These referred specimens (UCMP 117309 and UCMP 115855), both bearing Miller's identification, as well as a cast (in relief) of the holotype (LACM C697) are at hand. On the basis of comparison of size with these specimens, the fossils from Laguna Niguel are referred to *M. lompocanus*.

The two carpometacarpi measure 94.7 mm (LACM 37634) and 95.7 mm (LACM 77697) in length. By comparison, a carpometacarpus (LACM Bi 1764) of a female *M. bassanus* (Linnaeus 1758) is 90.0 mm, and Miller (1935:78) records another of this Recent species at 94 mm. The referred carpometacarpus of *M. lompocanus* (UCMP 115855) is 96.6 mm. Other fossil sulids in which this dimension is known are: *Palaeosula stocktoni* (Miller 1935), 102 mm; *Miosula media* Miller 1925, 81 mm; *Sula willetti* Miller 1925, 70 mm; *S. pohli* Howard 1958, 69 mm; *Microsula avita* (Wetmore 1938), 75 mm.

Carpometacarpus LACM 77697, the better preserved of the two Laguna Niguel carpometacarpi (Fig. 1 C, D), is similar in the shape of the process of M1 to *Morus bassanus*. But where the small foramina occur in the modern species, there is a deep, slit-like foramen — one anterior to the pisiform process, and one in a similar position at the base of M1 on the external side of the proximal end. The fossil also resembles *Morus* in the absence of pneumatic foramina at the posterior edge of the trochlea. Details of qualitative characters are not discernible on the Lompoc specimens.

Ulna LACM 37636 resemble *Morus* rather than *Sula* in the pneumaticity of the palmar face of the carpal process, and the size of the process. It is of the same distal breadth (10.5 mm) as the ulna of *M. bassanus* LACM Bi 1764. Measurements of ulnar breadth cannot be made on *M. lompocanus*, but the Laguna Niguel specimen corresponds favorably with the impression of the element on Lompoc specimen UCMP 115855.

Femur LACM 37633 conforms in proportions to a raised mold of the element made from the type impression of *M. lompocanus*. Similar dimensions measured on the two specimens are identical: breadth across anterior face of distal end 13.9 mm, breadth of shaft 7.0 mm. *M. bassanus* LACM Bi 1764 is larger in these dimensions (14.2 mm and 7.5 mm, respectively).

Tibiotarsus LACM 52217 conforms in size with *M. lompocanus* specimen UCMP 115855 from Lompoc. The bridge is less vertical in position than in *M. bassanus*, the upper edge being tipped posteriorly. This is true, as well, of the type tibiotarsus of *Miosula recentior* Howard 1949 (LACM 2117) from the Pliocene of San Diego, California. But the latter is distinguished from the specimen now at hand by less vertically oriented condyles. Measurements of LACM 52217 are: breadth of distal end 13.7 mm, depth of distal end 12.4 mm, ratio of depth to breadth 90.5%. The same dimensions in *M. bassanus* LACM Bi 1764 are, breadth 13.0 mm, depth 12.0 mm, ratio depth to breadth 92%.

The two proximal ends of tarsometatarsi (LACM 32428 and LACM 42657) measure 12.8 mm and 12.9 mm in proximal breadth, respectively. A mold of the posterior surface of this element on the type specimen of *M. lompocanus* measures 12.8 mm proximally. The impression visible on Lompoc specimen UCMP 115855 measures 13.5 mm. *M. bassanus* and a mold of the tarsometatarsus in the type of *Miosula media* Miller 1925 are broader (14.5 mm and 14.1 mm, respectively).

Morus magnus NEW SPECIES

FIGURE 3 B, C; 4 A, B

Holotype. — Nearly complete left carpometacarpus, LACM 37632, collected by Marion J. Bohrer, 1969, from LACM locality 6906.

Diagnosis. — More than 20% longer than female specimens of this element of *Morus bassanus*. Area above pisiform process depressed, with small pneumatic orifice. Externally, a deep, slit-like depression at base of process of metacarpal 1.

Measurements. — Greatest length 116.1 mm, breadth proximal trochlea 11 mm (approximately), breadth of shaft 9.6 mm.

Etymology. — The species name *magnus* (Latin, great) refers to the large size of the skeletal elements described.

Discussion. — Owing to the poor preservation of the holotype carpometacarpus, size is the outstanding distinguishing character. Of previously described sulids, *Palaeosula stocktoni* most nearly approaches *M. magnus* in length of this element (102 mm), but is still 13% shorter. Characters of the carpometacarpus other than length are not clearly discernible on the type slab of *P. stocktoni* (cast, LACM C743). It has been shown, however (Howard 1958), that at least the humerus of *Palaeosula* is markedly distinct qualitatively from either *Morus* or *Sula*. *M. magnus*, on the other hand, resembles the living sulids.

From the elements known, none of the other middle to late Tertiary fossil sulids gives evidence of approaching *M. magnus* in size.

Referred material. — Distal end of humerus, LACM 32430, and shaft of femur, LACM 37628, both from the type locality, LACM 6906, collected by Bohrer in 1969; and rostrum, LACM 77696, from locality LACM 6902, collected by Jennifer Whistler, June, 1975.

The humerus resembles *Morus* in contrast to *Sula* in the absence of the deep pneumatic foramen undercutting the external side of the olecranal fossa. The flat surface of the attachment for the anterior articular ligament, and its length relative to the distal breadth of the element is also similar to *Morus*. The attachment, however, projects slightly more palmar at its proximal end than in *M. bassanus*, and, in this respect, resembles *Sula*. In breadth the element is 22% greater than in *M. bassanus*.

The fragmentary femur is 18% broader than in *M. bassanus* in least breadth of shaft, and appears to expand to even greater relative breadth farther distad. It is difficult to be certain of accurately reproducing the same measurement in the two specimens as the distal condyles are lacking in the fossil.

The rostrum resembles *Sula* in the broad arch of the nasals, but bears resemblance to *Morus* in the depression of the dorsal contour anterior to the hinge. This depressed area, however, is shorter than in *M. bassanus*. In greatest breadth, it exceeds the rostrum of *M. bassanus* by 31% (see Table 2).

?Miosula media MILLER 1925

Referred material. — Tarsometatarsus lacking the proximal end, LACM 32431, from locality LACM 6906.

Discussion. — This specimen is heavier of shaft than the two proximal fragments of tarsometatarsus referred to *Morus lompocanus*. In breadth of distal end (17.6 mm) it is slightly larger than an incomplete mold of the tarsometatarsus made from the type skeletal impression of *Miosula media* (17.3 mm, approx.). Although neither the mold nor LACM 32431 is complete, both suggest a tarsometatarsus that is straighter of shaft than in *Morus*, but having the slightly raised internal trochlea characteristic of that genus as distinguished from *Sula*.

SULIDAE, spp. INDETERMINATE

Referred material. — A rostrum, LACM 73565, a proximal end of radius, LACM 58551, and a distal end of tibiotarsus, LACM 57834, all from locality LACM 6902; and a rostrum, LACM 37614, from locality LACM 6906.

Discussion. — Rostrum LACM 73565 (Fig. 4 C, D) bears strong resemblance to the cormorants in dorsal aspect, having deep lateral grooves setting off a narrow nasal process. There are, however, no dorsal foramina such as occur in *Phalacrocorax*. In palatal view, the resemblance is closer to the sulids. The palatines in the maxillo-palatine area are swollen, not flat, and are bordered laterally with wide, deep grooves. Posteriorly the maxillo-palatine area slants smoothly upward and bears very little perforation. In the slope of the area the specimen resembles *Morus*, in perforation it resembles

TABLE 2

Measurements (in millimeters) of *Morus magnus* and *M. bassanus*

	<i>M. magnus</i>	<i>M. bassanus</i> (LACM Bi 1764)
<i>Carpometacarpus</i>		
Greatest length	116.1	90.0
Breadth proximal trochlea	11.0 approx.	9.9
Breadth middle of shaft	9.6	7.4
Height process M1	16.0	12.0
<i>Humerus</i>		
Greatest breadth distal end	29.2	24.1
Depth distal end (externally)	17.0	14.4
Breadth of shaft immediately proximal to attachment for anterior articular ligament	22.8	17.0
<i>Femur</i>		
Least breadth shaft	8.9	7.1
Depth of shaft	9.6	7.5
<i>Rostrum</i>		
Breadth of frontonasal hinge	34.8	25.4-26.5*
Greatest depth	25.3	15.4-16.7*
Breadth nasal process	31.4	18.3-19.5*
Length	138.0 (estimate)	101.7-106.5*

*Maximum measurements from rostrum PB 16291, minimum from LACM Bi 1765.

both *Phalacrocorax* and *Morus*, but not *Sula*. This area in *Sula* rises more abruptly and is well perforated. The lateral pneumatic openings are much reduced in comparison to those found in the cormorants, and compare more favorably with those of *Morus*. Measurements of LACM 73565: greatest breadth 22.2 mm (approximately), greatest depth, 15:1 mm, breadth nasal process 5.2 mm.

In view of the fact that Miller (1925) noted certain characteristics of *Miosula media* that are cormorant-like, it is possible that this rostrum may represent that species.

The second rostrum (LACM 37614) is typically solid in all aspects. It is more massive than LACM 73565, but smaller than LACM 77696 referred to *Morus magnus*. Measurements: greatest breadth 24.0 mm, greatest depth 19.2 mm, breadth nasal process 21.8 mm.

The radius resembles *Morus bassanus* in general conformation and size, but is poorly preserved. The tibiotarsus is similar in characters of the distal end to LACM 52217 from Laguna Niguel, assigned to *Morus lompocanus*. The specimen is eroded so that measurements cannot be made precisely. It appears, however, to be narrower but relatively deeper than in LACM 52217, breadth of distal end 12.0 mm (approx.), depth of distal end 11.5 mm (approx.); ratio of depth to breadth 96%.

ORDER CHARADRIIFORMES
FAMILY ALCIDAE — AUKLIKE BIRDS

Discussion. — In addition to the six bones of *Praemancalla wetmorei* (subfamily Mancallinae) described earlier (Howard 1976) from localities LACM 6902, 6906 and 3185, the alcids from Laguna Niguel are represented by five fragments assignable to the Alcinae. In view of the fact that comprehensive studies of Tertiary alcids are under way by Storrs Olson at the United States National Museum of Natural History (Atlantic avifauna) and G. Victor Morejohn at California State University, San Jose (Pacific avifauna), I have refrained from attempting to name these poorly preserved specimens.

Five middle to late Tertiary alcines have been previously described from the west coast: *Aethia rossmoori* Howard 1968, and *Cerorhinca dubia* Miller 1925, from the Late Miocene; *Brachyramphus pliocen* Howard 1949, *Ptychoramphus tenuis* Miller and Bowman 1958, and *Cerorhinca minor* Howard 1971, from the Middle to Late Pliocene. East coast species are *Uria antiqua* (Marsh 1870), and *Miocepphus mcclungi* Wetmore 1940, from the Middle Miocene; and *Australca grandis* Brodkorb 1955, from the Middle Pliocene. A single species, *Uria ausonia* Portis 1887, is recorded from the Middle Pliocene of Italy (see Brodkorb 1967; and Howard 1968 and 1971). There is no indication that any of these species is represented by the material from the Laguna Niguel sites.

GENUS *Uria* BRISSON 1760
? *Uria* sp.

Referred material. — An incomplete proximal end of humerus, LACM 52018, from locality LACM 6902.

Discussion. — This poorly preserved specimen resembles the humerus in the murre in the long, oval pectoral scar, and prominent head widening towards the internal side and overhanging a broadly depressed tricipital area between the pectoral scar and the internal tuberosity. Both the deltoid and the bicipital crests are incomplete. That which remains of the bicipital surface is prominently raised proximally and bordered medially below by a deep groove; the bicipital furrow is a deep notch. These characters are most closely matched by humeri of Recent *U. lomvia* (Linnaeus 1758).

Comparisons were made with a cast of the type of *Uria antiqua*, provided through the courtesy of Storrs Olson, United States National Museum of

Natural History. Olson (personal correspondence) now refers this species to the genus *Australca* Brodkorb 1965. The cast is not only larger, but is much flatter in the bicipital area than in the Laguna Niguel specimen.

GENUS *Cepphus* PALLAS 1769

?*Cepphus* sp.

Referred material. — A proximal end of ulna with incomplete olecranon, LACM 47045, from locality LACM 6906.

Discussion. — This specimen resembles the ulna of the Pigeon Guillemot, *Cepphus columba* Pallas 1811, in the rounded shaft lacking a distinct keel anconally, and in having the brachial impression bordering the attachment for the anterior articular ligament and extending farther proximally than in most other genera of alcines. However, the brachial impression is broader in the fossil, and more deeply undercuts the attachment for the anterior articular ligament than in the Recent species. Also the attachment for the ligament is more prominent and more square in outline.

The possibility that this specimen might represent the genus *Miocepphus* prompted me to contact Storrs Olson. He reports (personal correspondence) that "*Miocepphus mcclungi* is one of the commoner birds in the Calvert Formation of Maryland and Virginia and I have many specimens that have not been reported on in the literature." He provided me with the loan of a complete ulna and humerus which he said "certainly pertain to this species." In the ulna (USNM 237219) the attachment for the anterior articular ligament is less prominent and more elongated than in LACM 47045, the brachial impression is narrower, and the shaft more compressed. LACM 47045 is not related to *Miocepphus*, which accords with Olson's observation that "*Miocepphus* is not related to *Cepphus*" but to the "*Alca-Uria* group of Atlantic alcids."

GENUS *Aethia* MERREM 1788

?*Aethia* sp.

Referred material. — Incomplete humerus, LACM 37686, from locality LACM 6906.

Discussion. — LACM 37686 is the smallest of the alcine bones from Laguna Niguel. It is possibly related to the Auklet, *Aethia rossmoori* Howard 1968, described from an ulna (LACM 18948) with referred distal end of humerus (LACM 18949), collected in the Monterey Formation at Leisure World in nearby Laguna Hills (locality LACM 1945). LACM 37686 resembles the humerus of *A. rossmoori* in the rounded shaft, position of the brachial impression with slight rise bordering it externally, and attachment of the anterior articular ligament facing more palmar than laterally. It is, however, 15% larger than the specimen of *A. rossmoori*. Also, although the area of the tricipital grooves is abraded, the grooves appear to be less deeply incised than in modern species of *Aethia*, or *A. rossmoori*.

TRIBE FRATERCULINI
GENUS AND SPECIES INDETERMINATE

Referred material. — Proximal end of humerus, LACM 42658, from locality LACM 7136, and distal end of humerus, LACM 37638, from locality LACM 6902.

Discussion. — Both humeral fragments resemble this element in the puffins (following Storer 1960:698, in segregating *Cerorhinca* in a tribe along with *Fratercula* and *Lunda*). The proximal portion (LACM 42658) resembles the type humerus of *Cerorhinca minor* Howard 1971 (LACM 15408), from the Pliocene of Baja California, Mexico, in the presence of a ridge from the head to the median crest, forming an internal border to the tricipital depression on the anconal surface below the head, and in the extension of the median crest to the border of the bicipital crest. In proximal breadth the Laguna Niguel specimen is 12.0 mm, which is markedly larger than this dimension in *C. minor* (10.5 mm). It is, in fact, closer in size to a humerus (LACM Bi 696) of *Lunda cirrhata* (Pallas 1769) which measures 12.2 mm in proximal breadth. Similarity to *Lunda* is seen in the extension of the pectoral attachment to the deepest part of the head, and, on the palmar side, the slight inset of the bicipital surface border from that of the bicipital crest. Similarity to *Fratercula corniculata* (Naumann 1821) is noted in the length of the bicipital surface, which becomes slightly pointed at its distal extreme. The tricipital depression below the head is shallower than in any of the specimens of Recent puffins at hand.

The distal portion of humerus (LACM 36738) also resembles this element in the Fraterculini. Its size suggests that it may belong to the same species as the proximal end discussed above.

The possibility that these two bones might be assignable to *Cerorhinca dubia*, described from the Late Miocene of Lompoc, was considered. However, their size seems to preclude this possibility. Miller (1925:116) gave the measurements of length for the type leg bones of *C. dubia* as 60 mm (tibiotarsus) and 29 mm (tarsometatarsus). These measurements in a series of ten specimens of *C. monocerata* (Pallas 1811) are 59.2 mm-60.0 mm, mean 62.9 mm (tibiotarsus), and 27.7 mm-30.6 mm, mean 29.1 mm (tarsometatarsus). The humeri from Laguna Niguel are relatively larger in comparison with the same series of skeletons of *C. monocerata*: proximal breadth (LACM 42658) 12.0 mm (*C. monocerata* 6.9 mm-11.3 mm, mean 10.6 mm); distal breadth (LACM 36738) 8.0 mm (*C. monocerata* 6.9 mm-7.8 mm, mean 7.2 mm).

GENUS *Praemancalla* HOWARD 1976
Praemancalla wetmorei HOWARD 1976

No further material referable to this species has been found at Laguna Niguel since the type description, which included: holotype humerus, LACM 42653, paratype ulna, LACM 32429, and referred proximal end of humerus, LACM 32432, all from locality LACM 6906; complete radius, LACM 53907,

and scapular end of coracoid, LACM 37637, both from locality LACM 6902; and proximal section of carpometacarpus, LACM 52216, from locality LACM 3185.

CONCLUSIONS

Seven families of marine birds are represented by the 39 identifiable avian bones from the Late Miocene deposits in Laguna Niguel. In the following list the numbers in parentheses indicate the number of specimens assigned to each species.

Gaviidae — Loons

Gavia brodkorbi new sp. (1)

Diomedeidae — Albatrosses

Diomedea ?californica (1)

Diomedea sp. indet. (2)

Procellariidae — Shearwaters

Puffinus barnesi new sp. (4)

Hydrobatidae — Storm Petrels

Oceanodroma sp. indet. (1)

Pseudodontornithidae — Extinct Bony-toothed Birds

Osteodontornis orri (3)

Sulidae — Boobies and Gannets

Morus lompocanus (7)

Morus magnus new sp. (4)

?*Miosula media* (1)

Sulidae, spp. indet. (4)

Alcidae — Auklike Birds

?*Uria* sp. (1)

?*Cepphus* sp. (1)

?*Aethia* sp. (1)

Fraterculini, gen. and sp. indet. (2)

Praemancalla wetmorei (6)

Five of the above families (Diomedeidae, Procellariidae, Pseudodontornithidae, Sulidae and Alcidae) are also represented in the larger collection of Late Miocene birds recovered earlier from locality LACM 1945 in Leisure World, Laguna Hills, about three miles north of Laguna Niguel (Howard 1968). However, few of the same species are listed from the two sites and none of those described as new from locality LACM 1945 is found in the Laguna Niguel area. From locality LACM 1945, 50% of the 120 bones identified are of the Procellariidae (4 species), with Sulidae (3 species) and Alcidae (5 species) constituting approximately 22% each. The remaining 6% include the Anatidae (2 species), Diomedeidae (2 species) and ?*Osteodontornis orri*.

At Laguna Niguel only 10% of the 39 identified bones are procellariid (1

species). The Sulidae are most abundant, making up 41%, followed by the Alcidae 28%. *Diomedea* and *Osteodontornis* constituting 7½% each, are relatively better represented than at locality LACM 1945. A loon (Gaviidae) and a storm petrel (Hydrobatidae), not present at LACM 1945, complete the avifauna. The Anatidae are not represented.

Although the deposits at both of these sites are in the Monterey Formation of Late Miocene (Clarendonian correlative) age, comparison of the two avifaunas strengthens the belief suggested by a comparison of the mancalline auks (Howard 1976) that the fauna from Laguna Niguel represents a slightly later time than that from locality LACM 1945. Not only is the mancalline auk, *Praemancalla wetmorei*, from Laguna Niguel further specialized for wing-propelled diving than is *P. lagunensis* from locality LACM 1945, but in the Laguna Niguel sites there is less indication of persistence of Middle Miocene species and a more definite representation of typical Late Miocene species. At locality LACM 1945, *Presbychen abavus* Wetmore 1930 and *Puffinus priscus*, both described from the Middle Miocene Sharktooth Hill Bonebed, are listed. Neither has been found at Laguna Niguel, although another species, *Diomedea californica*, described from the same locality, is tentatively identified. On the other hand the typically Late Miocene *Morus lompocanus*, which is only tentatively identified at locality LACM 1945, is the most abundant species at Laguna Niguel. *Osteodontornis orri*, tentatively listed from LACM 1945, on the basis of a single fragment, is definitely present at Laguna Niguel.

Some significance also may be attached to the occurrence of *Gavia* and *Oceanodroma* at Laguna Niguel. This is the first Miocene west coast occurrence of the loons (Gaviidae). The only previous record for *Oceanodroma* is *O. hubbsi* Miller in the Capistrano Formation, which is now considered to be of latest Miocene to early Pliocene (Hemphillian correlative) age (Fife 1974:19) rather than Middle Miocene as interpreted by Miller (1951).

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